SOUTH FLORIDA WATER MANAGEMENT DISTRICT

What Happens When You Aren't at Your Sampling Site? Cameras document impacts to deployed equipment, with implications for nutrient budgets

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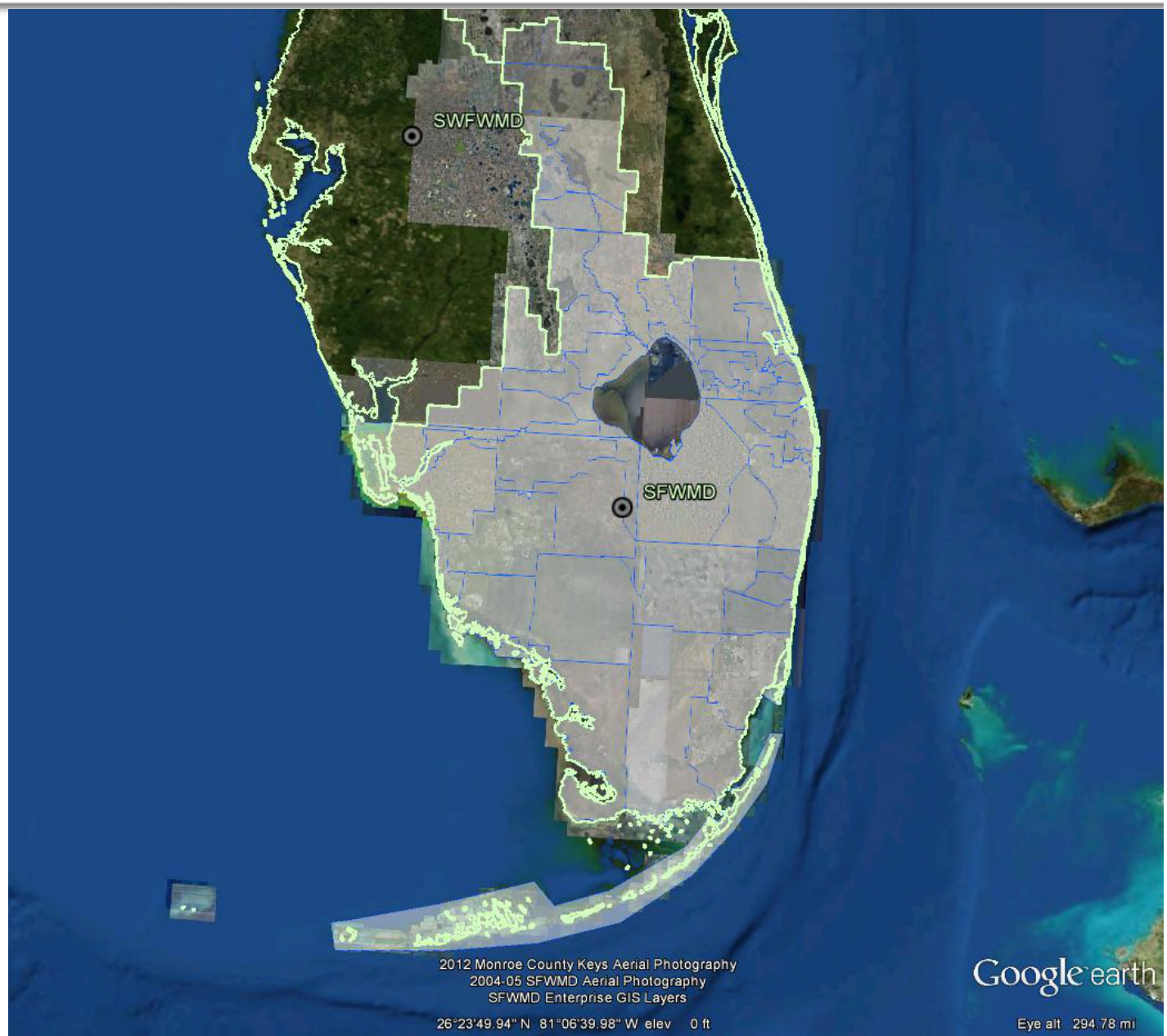
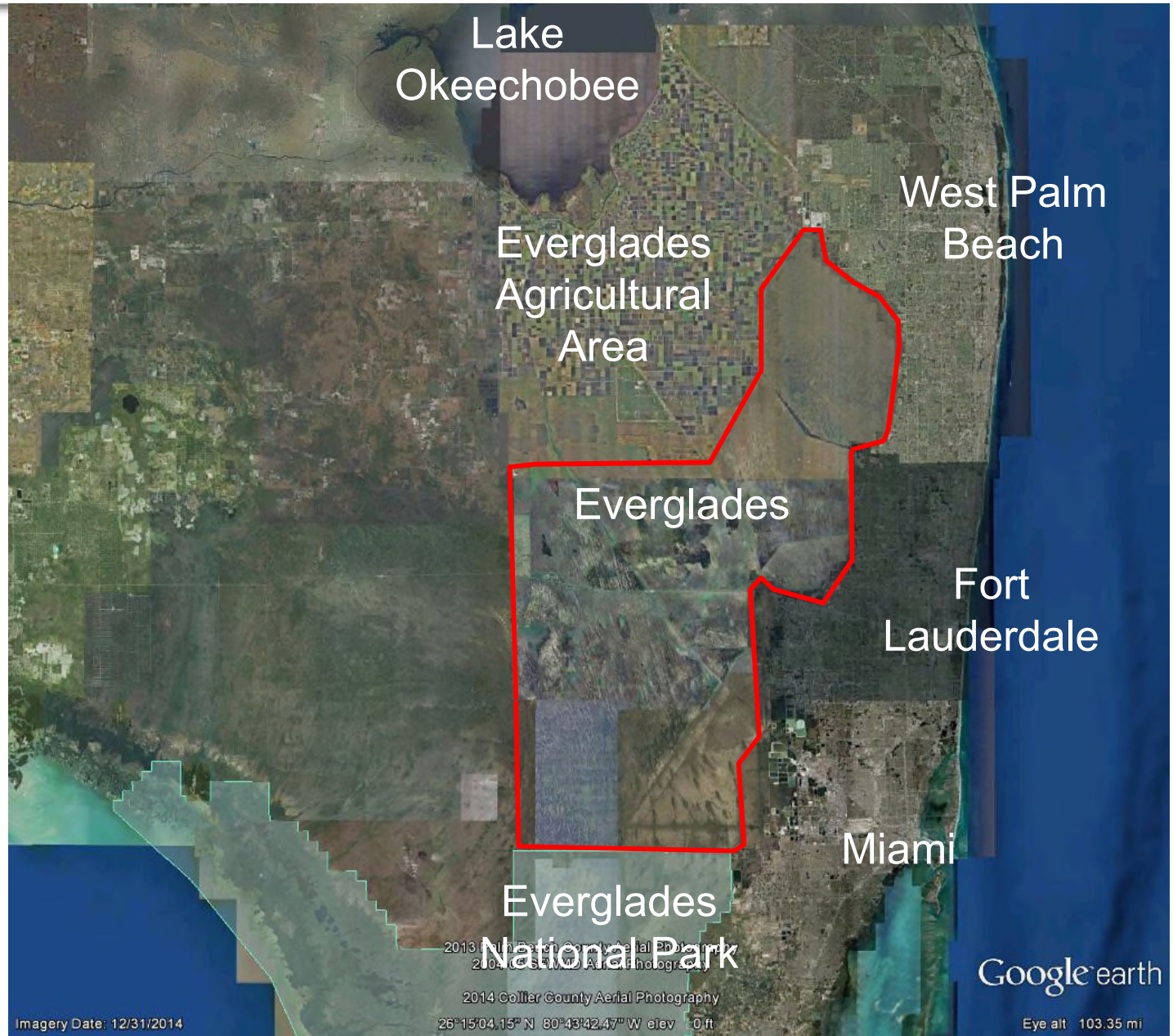
SFWMD

- The South Florida Water Management District extends from Orlando to Key West and is responsible for flood control and Everglades restoration



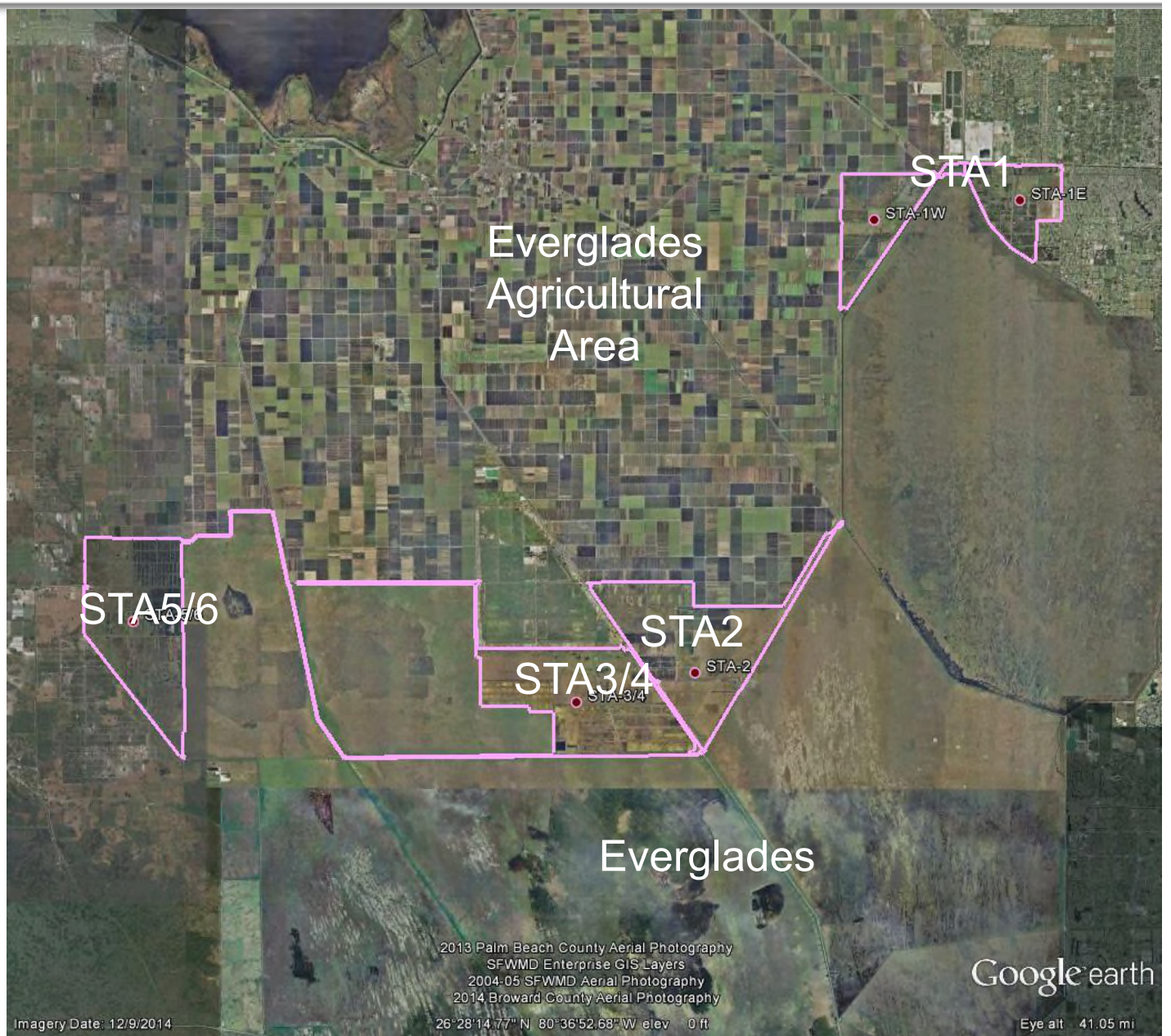
Lay of the Land

- The remnant Everglades sits between the urbanized coast to the east and the agricultural area to the north



Stormwater Treatment Areas (STAs)

- As part of a Federal settlement agreement, the SFWMD has built more than 60,000 acres of filter marshes to treat agricultural runoff before it is discharged to the Everglades



Discharge Limits

1. There are 42 STA discharge structures (pumps and culverts) monitored at 27 representative sites
2. Total Phosphorus discharge limit for each STA is set by State and Federal permits at a long-term flow weighted mean of 13 ug/L as collected by flow proportional autosamplers
3. Any systematic errors in this sampling could be serious

Motives for the Sampling Study

- Representative data needed to support multiple efforts
  - Calculation of the annual flow-weighted mean (compliance)
  - Evaluation of various TP removal optimization treatments
- Systemic issues interfere with representative sampling
  - No sampling system can be perfect at all times
  - As the process becomes more complicated and decentralized, the potential for failure increases
  - As nutrient concentrations decrease with improved treatment, the relative importance of interferences increases
  - Problems with sampling systems must be identified to be resolved
- Sampling methods must be representative, reproducible, transferable, cost-effective, and sustainable

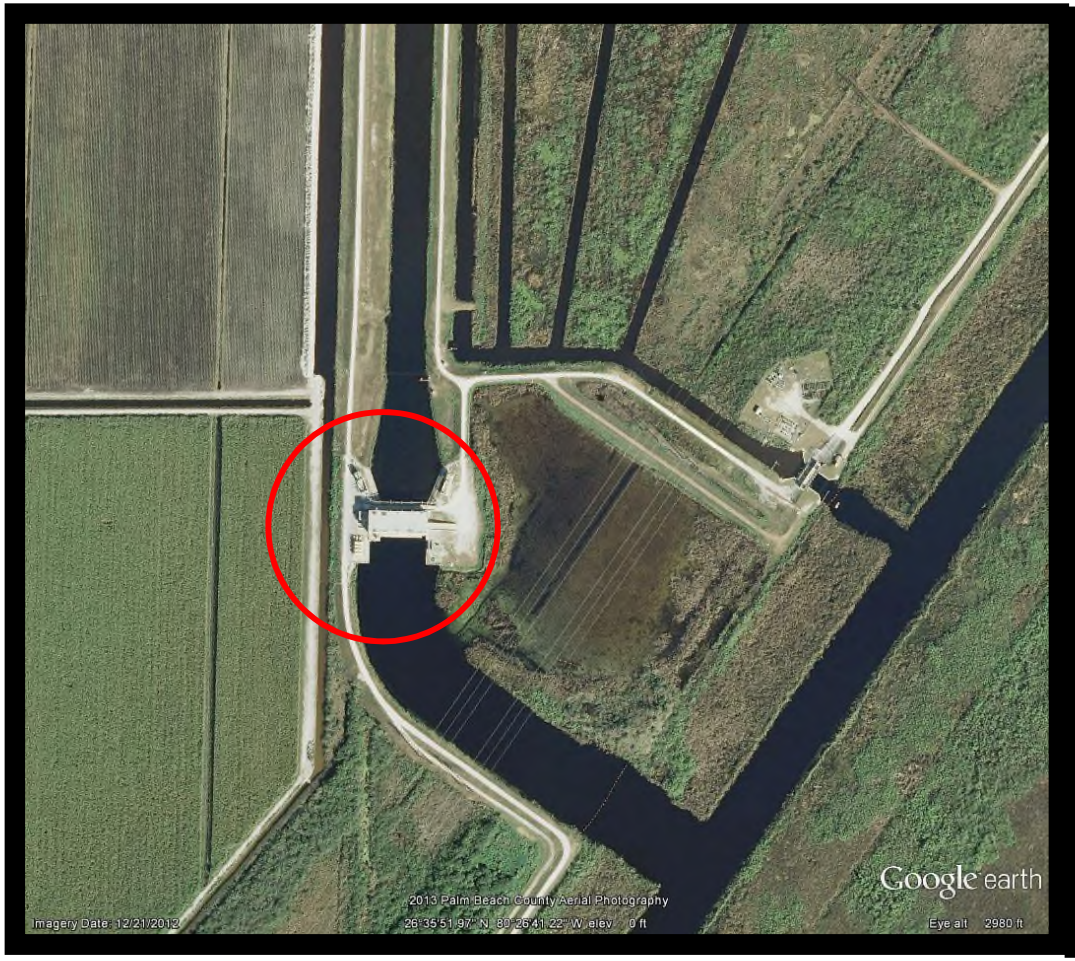
Remote Environmental Sampling Test Project

- Pilot Project at 2 STA structures - G310 and G390B
  - Gathered information on several sampling systems to identify discrepancies
  - Reviewed sampling processes and assumptions
  - Observed and recorded field conditions using cameras
  - Improved sampling performance, user understanding and data interpretation
- This presentation summarizes
  - Identification of potential interferences with representative samples
  - Extrapolation of observations and the implications for nutrient budgets and compliance

Locations of G310 and G390B

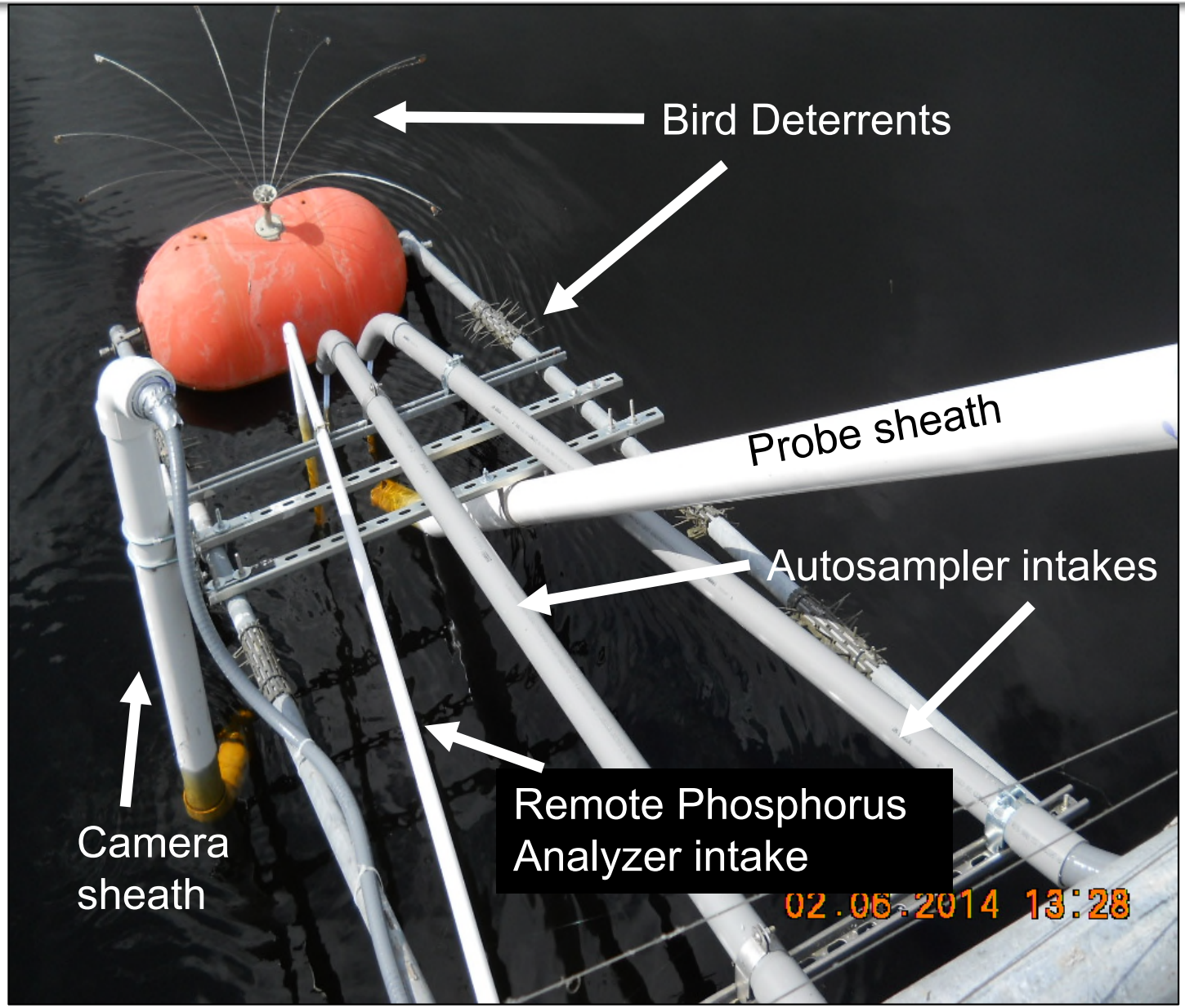
G310 and G390B Layout

G310 is a large pump discharging from STA1W



G390B is a small inflow gate for the PSTA project in STA3/4

Typical Floating Sampling Arm



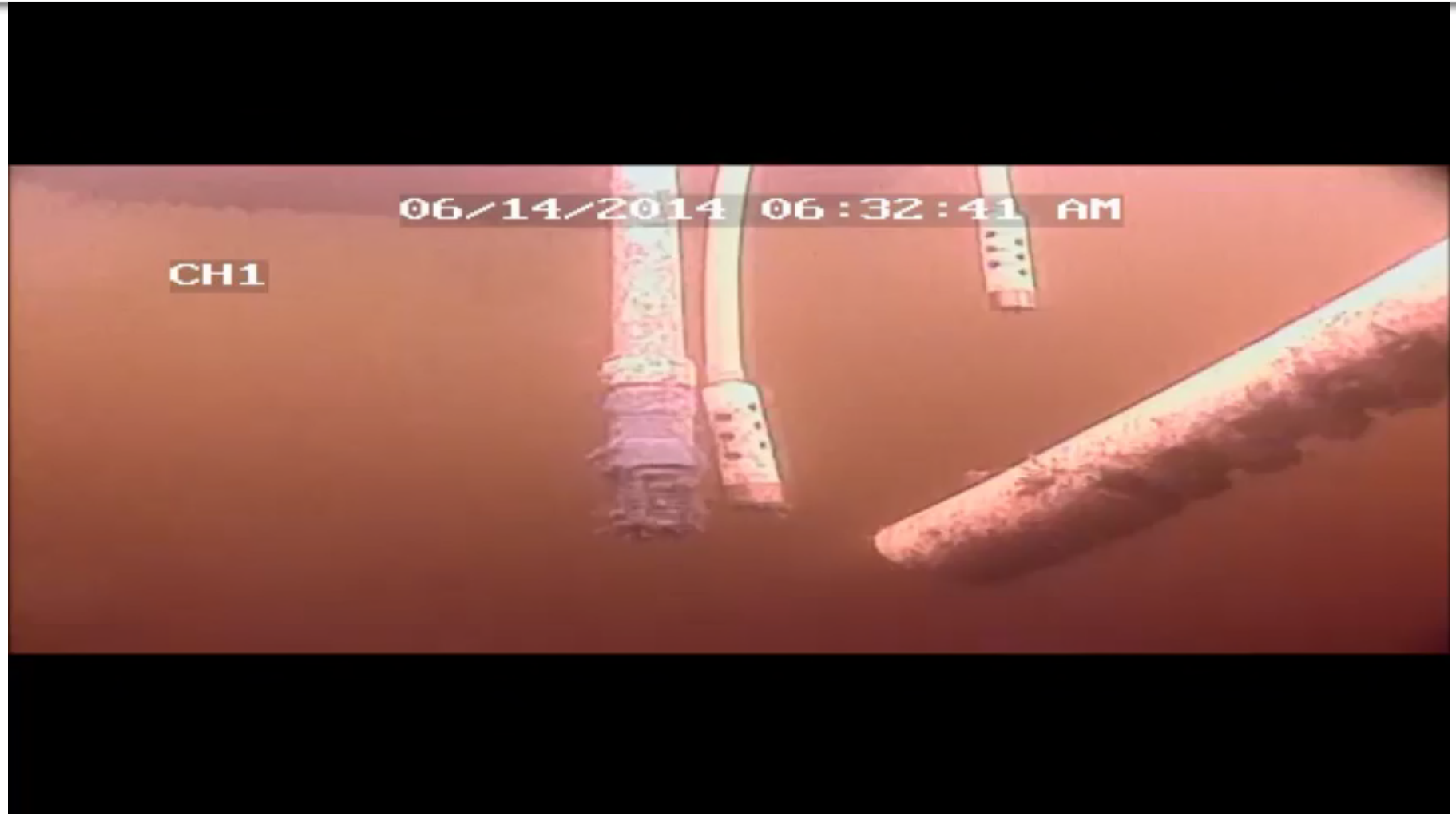
Multiple Issues Identified

- Operational Issues
  - Eddies
  - Particle/Detritus suspension
- Vegetation Issues
  - Floating mats creating unrepresentative conditions
  - Floating mats clog sampling intakes
- Wildlife Issues
  - Alligators and mammals were not an issue
  - Fish (Preyfish, Bass, Sunfish, Gar, Exotics)
  - Turtles
  - Anhingas and vultures

Eddies and Detritus

During flow, material built up on the structure itself, can fall into the water column. This includes dried algae, fungi, dead insects, and waste products from vultures, bats, spiders, etc. Caught in the eddy, it can pass over sampling points multiple times as it dissipates

Flow and Detrital (re)suspension



During short duration and low flow events deposited detritus remains immobile

Flow and Detrital (re)suspension

As flows are sustained and increased detritus is mobilized

Floating Vegetation

Vegetation impacting the sampling intakes creates unrepresentative conditions, but whether this acts as a contaminant or a particle filter probably depends on a variety of factors. Strap-like vegetation acts to seal the intake and burn out sampling pumps.

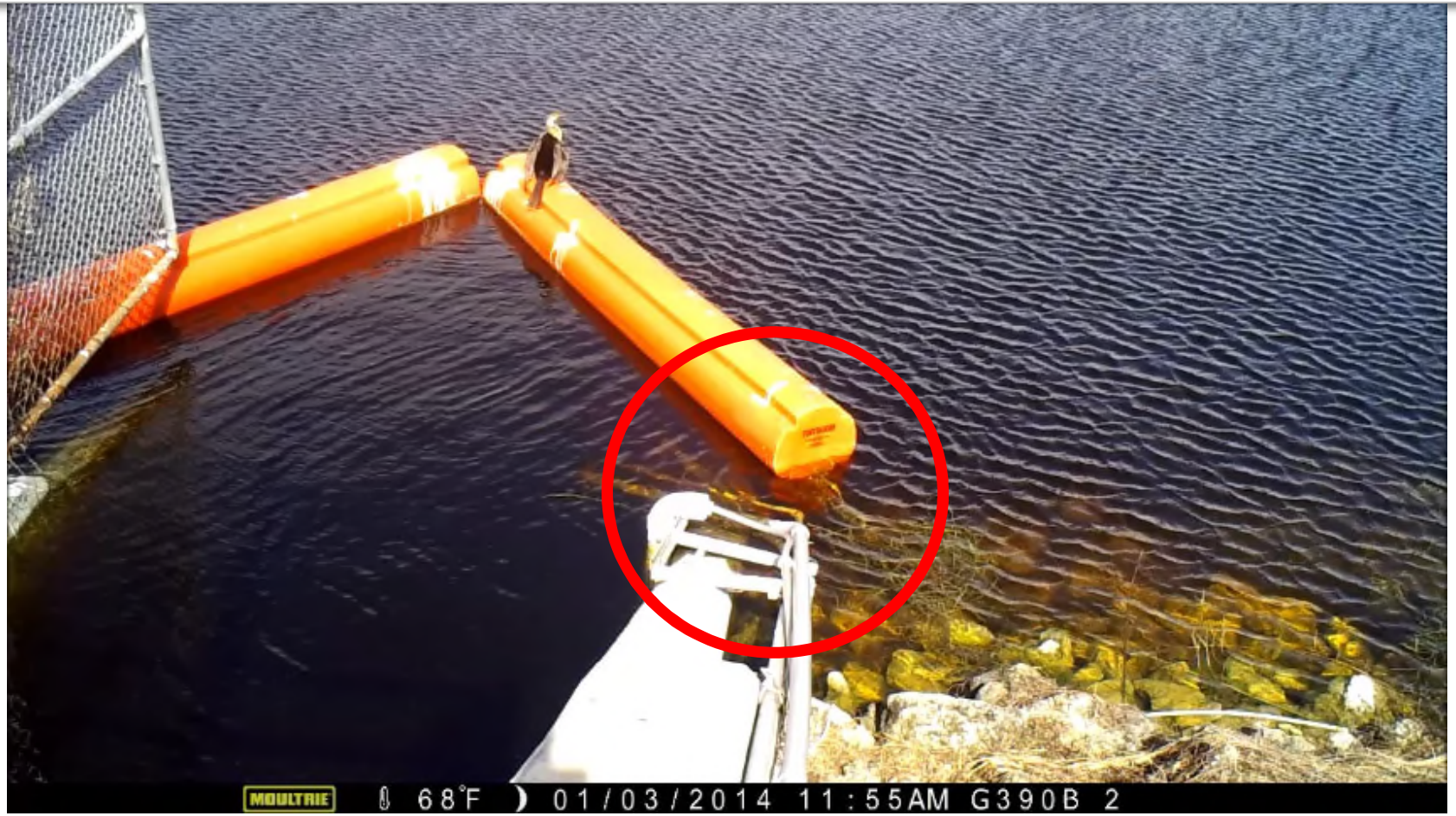
Fish at G310

Small fish, gar and sailfin catfish dominated G310, likely because this collection canal had no connectivity with marshes and therefore limited cover.

Fish at G390B

Sunfish, bass and tilapia dominated G390B. This collection canal had direct connection with the marsh. The impact of fish on TP concentrations is probably unquantifiable and unresolvable

Turtles



Ignore the anhinga for a moment, turtles, while seemingly innocuous, were caught climbing, resting and feeding on equipment

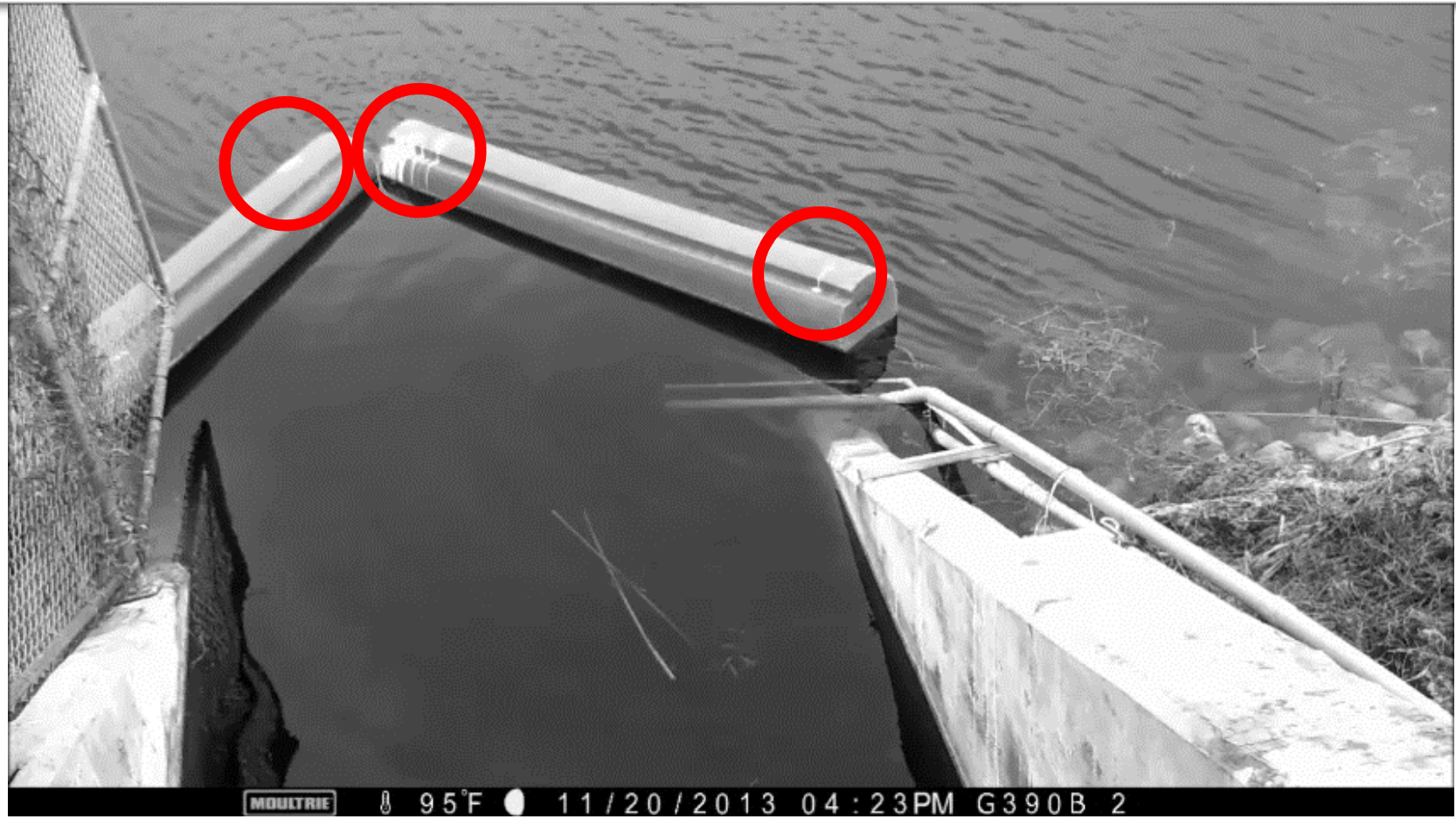
Turtles

Turtle interactions with the equipment released a significant amount of debris into the water column

Anhingas as an Acute Problem

Anhinga defecation into the water column creates an obvious sampling issue. The chances of collecting this material in any one sample is low, but given the number of samples that are collected it is likely that some elevated samples are the result of this problem

Anhingas as a Chronic Problem



The build up of waste on the weed barrier creates a source, changing the nature of low TP rain events

Summary of key environmental interferences

- Fish effects may be unquantifiable
- Turtles frequently disturbed settled detritus and algae
- Floating vegetation may act as a contaminant in the autosampler, it may also act as a filter
- Anhingas feces are likely a significant concern
  - Irick et al., 2015 estimated TP in wading bird feces to range from 21-57 g/kg
- Surrounding infrastructure acts as reservoirs for waste products

Extrapolation

- Sampling equipment, structures, and levees are potential sources of TP
  - Wildlife attractor/corridor/nesting site
  - Levee material itself contains TP
  - Levee vegetation mines TP and incorporates it into leaves
- Rain events may wash debris (animal waste, clippings and levee material) into the water, potentially elevating TP concentration locally
- Similar processes on highways near wetlands are usually resolved with swales

Validation

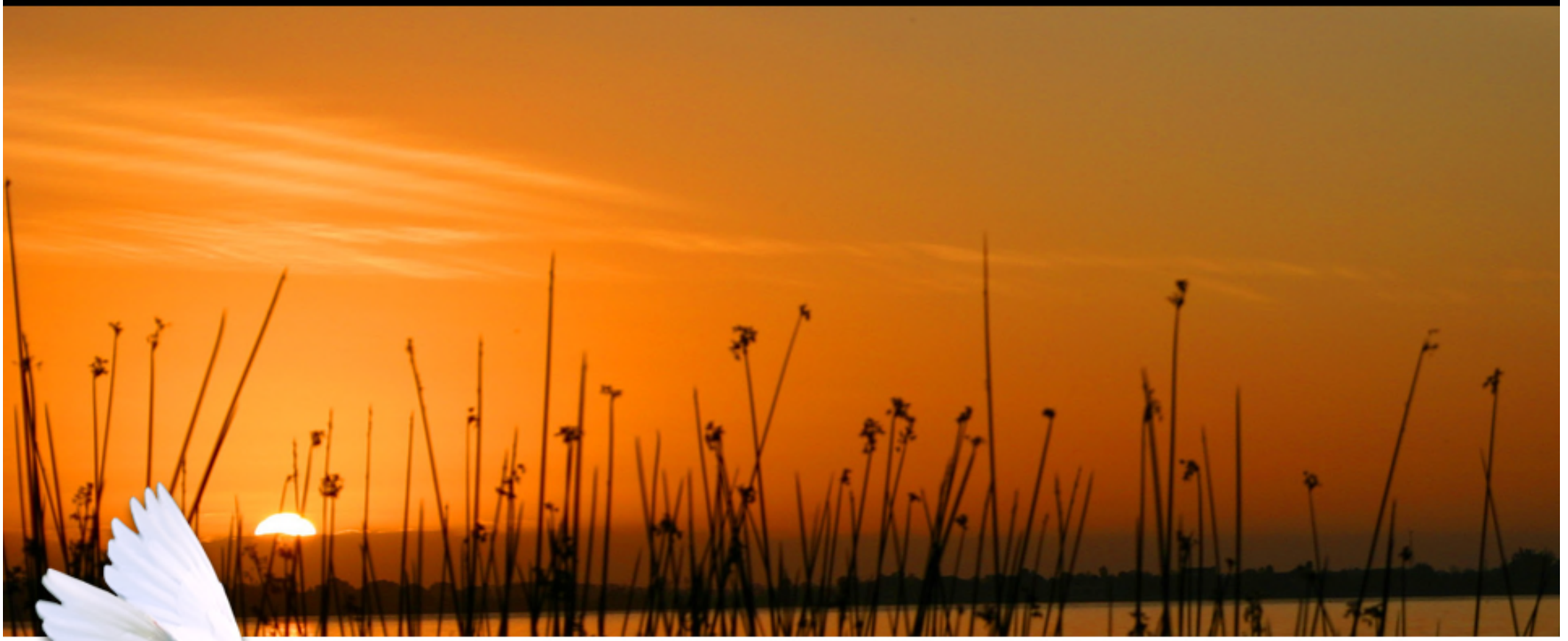
Sediment runoff observed at G378E on 1/27/2016

Extent of Potential Problem (example)

- Research and Monitoring has been focused on point sources and marsh processes
- Terrestrial biogeochemical processes may turn levees and infrastructure into non-point sources
- Non-point sources have the potential to increase TP concentrations in localized areas (edge effects)
- The subdivision of a treatment wetland may unintentionally create non-point sources
- Non-point sources should be evaluated and where possible mitigated to reduce TP inputs

Monsters!

This footage was captured very early in the project and the creatures seen here were never documented again. These two worm-like creatures take about 8 minutes to travel six feet. It is suspected they are an exotic species of giant flatworm (*Platydemus manokwari)*



Questions